APPLICATION FOR
LETTERS PATENT OF THE UNITED STATES

CERTIFICATE OF MAILING
"EXPRESS MAIL"

"Express Mail"
Mailing Label Number EK 295 543 075 US

Date of Deposit JAN 18 2001

I hereby certify that this paper or fee is being deposited with the United States Postal Service "EXPRESS MAIL POST OFFICE TO ADDRESSEE" Service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Shirley Doll
(type or print name of person certifying)

Signature

SPECIFICATION

To all whom it may concern:

Be It Known, That I, **Timothy W. Rawlings**, of Waynesville, Ohio, have invented certain new and useful improvements in **FOLDABLE PRINTABLE SUBSTRATE**, of which I declare the following to be a full, clear and exact description:

FOLDABLE PRINTABLE SUBSTRATE

Field of the Invention

The invention relates to printable substrates which are to be folded without separation along a fold line.

Background of the Invention

Substrates that run through printers such as laser ink jet printers and copiers often incorporate perforations. There are perforations which aid in tearing the substrates into sections and there are perforations used to weaken a sheet to facilitate folding. Standard perforations visible to the naked eye have extraneous fibers and the cuts and ties have sharp edges that nest into underlying substrates when stacked or catch on paper handling equipment as the substrate travels along its path through a printer. This can cause double feeding of substrates into the printers and copiers and also jamming of the paper handlers. The use of microperforations has been shown to minimize if not eliminate feed problems within printers and copiers. The small cuts and ties do not create edges that nest or catch on the paper handling equipment.

Microperforations weaken a substrate and are generally acceptable for providing a line of separation in a substrate. The conventional use of microperforations weakens substrates too much to provide fold lines. The weakened substrate will typically partially separate or fall apart when additionally weakened by folding or will separate upon use after folding. U.S. Patent 5,136,130 states at col. 2, lines 27-35 that: “These microperforations formed a weakened line across a sheet which was greatly weakened by a fold along the perforations, so that the sheets required less than 1 or 2 kilograms of force for separation and these weakened sheets did not print reliably following folding and unfolding”.

Summary of the Invention

It is desirable to provide a printable substrate for passing through a printer or a copier which may be readily folded and subsequently unfolded at a fold line defined by microperforations, either before or after being feed through a printer or copier, without tearing at the fold line. There is provided by this invention a printable substrate for passing through a printer or copier comprising a print medium adapted to print desired indicia thereon and one or more fold lines within said print medium. The one or more fold lines comprises a discontinuous line of both microperforations extending into said print medium and intermittent non-perforated sections that extend along the length or width of the print medium. The fold lines define locations where the print medium can be easily folded. Folding, as defined herein, comprises bending a substrate from 90 degrees to 180 degrees, where bending a substrate 180 degrees is equivalent to overlapping one portion of the substrate with another to lie flat. The fold lines permit the print medium to be folded and unfolded at least once along their length without separation either before or after printing.

The substrate used in the present invention may be in the form of continuous rolls, separate sheets, continuous fanfold sheets or laminates such as label laminates or forms having labels integrated therein. The label laminates and integrated forms typically comprise a sheet of print medium, adhesive and a base sheet. The print medium of the substrate may be comprised of various materials including paper and plastic materials (acrylic sheets). The print medium can have a thickness ranging from about 3 to 20 mils with a thickness of 6 to 10 mils being preferred and can include onion skin paper, calendared papers, supercalendared papers, card stock, thermal paper and bond paper.

Substrates in the form of continuous rolls can have a width consistent with cash register receipts up to widths consistent with newspaper sheets. The separate paper sheets can also vary widely in size with conventional sizes such as letter size, A4 and legal size being most preferred. The continuous fanfold paper can vary widely in width from label sheets to tractor fed plotter paper.

The print medium may have preprinted indicia thereon such as those used on conventional business forms. The print medium has one or more fold lines which defines locations where the print medium that can be easily folded . The conventional separate sheets (letter size, A4 and legal size) typically have from 1 to 3 fold lines to reduce the size of the substrate to one which will fit within a conventional legal size envelope (4.25"w x 9.5"l). The fold lines can extend along the length or width of the print medium.

The one or more fold lines are comprised of microperforations extending through or substantially through the thickness of said print medium. The fold lines also comprise intermittent non-perforated sections. The microperforations suitable for use in this invention comprise cuts, including slits or round holes, having a maximum dimension of less than 0.75 mm. Preferably, the microperforations have a maximum dimension of less than 0.50 mm and most preferably, the maximum dimension is in the range of 0.2 mm to 0.4 mm. Perforations of this size are effective and preferably, not readily visible to allow printing on the fold line.

The ties between the microperforations are preferably less than 0.5 mm in length and most preferably in the range of 0.2 mm to 0.4 mm. Microperforations having ties and cuts (slits/holes) with the preferred dimensions typically have at least about 35 cuts and 35 ties per linear inch, although many more may be present. Microperforations having 50-70 cuts and 50-70 ties per inch are common.

The perforations can extend all the way through the print medium or they can extend substantially through the print medium i.e., about 40 to 95% of the thickness of said print medium.

The microperforations do not extend across the whole length of the fold line. The fold line is shared with intermittent non-perforated sections. The extent to which non-perforated sections are present is dependent on the strength desired of the fold line. It is contemplated from 10 to 80% of the fold line can comprise intermittent non-perforated portions, depending on the strength of the print medium. In amounts less than 10%, the non-perforated portions will either be so short or so infrequent as to provide little additional support for the print medium. If over 80% of the fold line comprises non-perforated portions,

the microperforations will be so finely dispersed and short in length as to provide little contribution to the weakening of the print medium to define a fold line. The non-perforated portions preferably form from 40 to 60% of the fold line for conventional bond and thermal paper sheets. This range will be different for different print media. For example, laminates such as label laminates will require more microperforations to define a fold line.

The intermittent non-perforated sections preferably vary in length from about 1 mm to 5 mm, preferably about 2.5 mm, but can have a length which is up to 20% of the total width of the print medium.

The fold lines within the print medium can be produced by methods consistent with conventional techniques, i.e., by microperforating the print medium with a straight or circular cutting blade having a number of uniform nicks in the cutting edge. These nicks provide protrusions which pierce the print medium. To provide for the intermittent non-perforated sections, the nicks can be spaced apart to provide the desired length of the non-perforated portion (from 1 to 5 mm). Alternatively, various segments of the fold lines can be impacted by a short blade providing the desired microperforations.

Brief Description of the Drawing

Figure 1 is a perspective view of a printable substrate of this invention.

Figure 2 is a magnified view of a fold line in the printable substrate of Figure 1.

Figure 3 is a magnified view of another fold line in the printable substrate of Figure1.

Figure 4 is another magnified view of a fold line in the printable substrate of Figure 1.

Detailed Description

Figure 1 illustrates a business form 10 consistent with the present invention having fold lines 5 and 15. Figure 2 is a magnified view of fold line 5 showing micropreforations 8 and ties 9. This magnified view shows that fold line 5 comprises non-perforated sections 6 and microperforated sections 7 of equal length both alternating in continuous fashion along the length of fold line 5. Figures 3 and 4 are magnified views of fold line 15 showing

microperforations 8 and ties 9. As shown by Figures 3 and 4, fold line 15 comprises non-perforated sections 14 of varying length across fold line 15 with longer sections at the edges than at the center of fold line 15 with microperforated sections 16 therebetween. In preferred embodiments, these non-perforated sections are aligned with feed rollers of the printer so as to avoid separation of the print medium during printing.

The entire disclosure of all applications, patents and publications cited above is hereby incorporated by reference. From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention and, without departing from the spirit and scope thereof can various changes and modifications of the invention to adapt it to various usages and conditions.